

Spectral self-similarity in fractal one-dimensional photonic structures

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Fractal one-dimensional (1D) photonic structures exhibit scalability in transmission spectra, which results from its geometrical self-similarity (SS) [1]. Here we report that besides scalability, optical spectra of 1D fractal structures possess self-similar (or fractal) properties. Unlike in quasiperiodic structures where transmission peak frequencies form a fractal Cantor set [2], SS in fractal structures is present in the shape of transmission spectra envelopes, i.e., in the relative depth of dips between transmission peaks. To observe SS and scalability appearance, one needs to apply a power transformation of transmittance magnitudes in addition to the frequency scaling (Fig.1). The scaling factor and the value of power are both related to the geometrical parameters of the structure in question. Our conclusions are illustrated numerically by some examples.

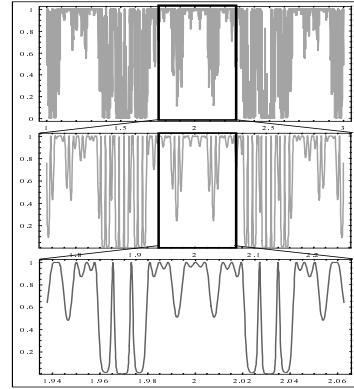


Fig. 1. Transmission spectrum $T(\omega)$ of $(4,\{1,2\},5)$ fractal structure (see [1] for notation), the central area repeatedly scaled in frequency by 4 and T raised to 7th power

- [1] S. V. Zhukovsky *et al*, *Europhys. Lett.*, **66**, 455 (2004).
- [2] M. Kohmoto, B. Sutherland, *Phys. Rev. B*, **35**, 1020 (1987).